# THE NEW SCIENCE OF PLANT SOCIOLOGY

By Dr. ROLAND M. HARPER

COLLEGE POINT, MD.

SOME of the sciences dealing with mankind, such as anthropology, anatomy, physiology and sociology, are pretty closely paralleled by sciences dealing with the vegetable kingdom. Plant sociology (or phytosociology), the science of plant societies, or vegetation, is analogous in many ways to human sociology, the science of human society, or population. Although human sociology deals with only a single species, *Homo sapiens,* it classifies him according to occupations, forms of government, etc. Plant sociology differs in dealing with a multitude of species, but these may be grouped according to structure and adaptations, which are analogous to the qualifications and occupations of men.

A pioneer human society is chiefly made up of hunters, prospectors, cowboys, lumbermen and other resourceful but not highly educated people, while urban society is much more complex, and contains many notables and nobodies, specialists, dependents, idlers and parasites. Likewise a pioneer plant society may consist largely of lichens, mosses and other hardy forms, while in a dense "climax" forest there are tall trees and low herbs; vines and epiphytes, which depend on the trees for support; saprophytes or humus plants, which live on decayed leaves furnished by other plants; and often many parasites as well.

As has been the case with most other sciences, some of the foundations for the one under consideration were laid long before it was thought of as a distinct subject for study. A century and more ago a few observant travelers, even some without botanical training, were describing vegetation correctly though rather superficially; and some of the fundamental principles of the science have been known and used by foresters for several decades. But there is scarcely a hint of the sociological point of view in nineteenth century botanical text-books, classifications of vegetation did not begin to appear in botanical literature until about twenty years ago, and the term plant sociology itself is only about four years old.[1]

A few years ago plant sociology was partly confused with the almost equally new sciences of plant geography and ecology; and such terms as ecological plant geography, meaning the geography of plant associations, and synecology, meaning the relation of such associations to

[1] See *Torreya,* 16: 138, June, 1916. Readers who do not have access to botanical magazines can find a short article on the subject by the writer in the current edition of the New International Encyclopædia.

environment, are occasionally seen now. But geography deals primarily with distribution, ecology with environment, and sociology with association interrelations, three fundamentally distinct points of view. Like every other distinct science, plant sociology has laws peculiar to itself, as will be shown presently.

Probably the most obvious feature of vegetation, the world over, is that it is divisible into groups of more or less homogeneous aspect, such as forests, thickets, meadows, prairies, marshes and deserts. The first step in plant sociology therefore is to classify these vegetation types or associations; just as the early botanists, zoologists and mineralogists were occupied principally with classifying plants, animals and minerals. As a given type of vegetation is commonly correlated with a certain combination of soil, climate and other environmental factors, the first classifications of vegetation were primarily classifications of habitats; and it is indeed difficult to study vegetation without reference to its habitat.

The next step is to analyze each vegetation type. At first, say in the last decade of the nineteenth century, this was done by merely listing the species of plants in each habitat, in botanical or alphabetical or fortuitous order. But it is much more to the point to divide the plants into trees, shrubs, vines, evergreens, perennials, annuals, etc., regardless of their names or taxonomic relationships; though as yet there is little agreement among botanists as to the details of such a classification. It is also very important to determine the relative abundance of the different species or structural categories, for obviously a forest with more pines than oaks, or more shrubs than trees, has a different meaning from one in which the proportions are reversed.[2] For this sort of investigation demography, meaning the study of population, would probably be a better term than sociology, for in it the interrelations of the plants are not specially considered, and the study is static rather than dynamic.

It might be justly said that the demographic study of vegetation has hardly begun, even in the neighborhood of some of the greatest research centers, and there are thousands of square miles in nearly every state and country where we know at present practically nothing of the details of the vegetation, as distinguished from the flora. In the United States the greatest activity in this line has been manifested in and near the upper Mississippi Valley; and nearly all descriptions, photographs and maps of vegetation hitherto published for New England, New York, the south and the far west are the work of men born or trained elsewhere. (The reasons for this state of affairs are somewhat different in each case, and rather complex, and need not be discussed here.) The invention of the half-tone process, about thirty years ago, was a boon to the (then unknown) plant sociologist, for the possibility of making accurate

[2] See 6th Ann. Rep. Fla. Geol. Surv., pp. 175–177 (footnote), 1914.

reproductions of photographs at small expense greatly facilitates the study and comparison of vegetation types.

In dynamic plant sociology, as distinguished from demography, we are concerned among other things with the competition and cooperation between neighboring plants, or the struggle for existence; the rate of establishment and average longevity of the trees or other plants (either collectively or one species at a time), and the annual growth (absolute or relative) of wood, or of all vegetation, per unit area. Such studies, which are analogous to studies of the birth and death rate in human society, have already been pretty highly developed by foresters.

A most interesting phenomenon of plant sociology, which is going on everywhere all the time, but so slowly that it is not easy to observe or to experiment with, and was hardly thought of up to twenty years ago, is succession, which is the gradual replacement of one type of vegetation by another, with or without a concurrent fundamental change in environment.[3] Many botanists have exercised their imaginations by theorizing on this subject, but often with too slender a foundation of facts and therefore without getting definite and convincing results. When quantitative studies of vegetation become more universal, however, the study of succession will be on a more solid basis. One might as well try to discuss the movements of population in the United States without census statistics as to speculate on succession of vegetation without knowing the relative abundance of the species.

Another problem for the plant sociologist is to determine the normal frequency and effect of fire in each type of vegetation. Most people, even foresters, seem to regard forest and prairie fires as mere accidents, to be prevented if possible; but a few ecologists have already studied fire as a normal environmental factor. As fire does not attack scattered or isolated plants, of one species at a time, as a disease or other enemy might, but sweeps through the vegetation when conditions permit, its frequency and intensity depend mostly on the character of the vegetation, and are therefore sociological problems.[4]

The old question of why prairies are treeless, which has been much discussed by geologists, geographers, ecologists, etc., but never satisfactorily answered, is essentially a sociological problem, and perhaps it will be solved when sociological and demographic methods are brought to bear on it. A few of the other problems in plant sociology awaiting solution may be illustrated by the following questions, most of which

[3] The principles of succession have been pretty fully elaborated by Dr. H. C. Cowles in papers published in *The Botanical Gazette* in 1899, 1901 and 1911.

[4] See *Popular Science Monthly*, 85: 338 (footnote), October, 1914. The average forester to-day, probably largely on account of European traditions and teachings, seems to be almost as skeptical about forest fires being part of the natural order of things as the members of the Inquisition three centuries ago were toward Galileo's views about the movements of the earth.

deal with matters easily observed by persons who know nothing of botany. (A trained botanist can easily think of scores of others.)

Why are the tallest trees in a given forest usually all about the same height, regardless of species?

Where are the densest forests in the world? The fastest-growing?

What is the relation between the average distance one can see in a forest and the amount of timber per acre?

In the same climate which takes the most food and water from the soil: forest or prairie?

What keeps evergreen trees from growing in the richest soils, in the eastern United States?

Why are weeds detrimental to crops?

Why are prairie and pine-barren plants all or nearly all perennial?

If the climate became a little colder or warmer, wetter or drier, what plants would become more (or less) abundant?

Most of the sciences have one or more arts based on them, and this is true even of such a new science as plant sociology. Its most important application is in forestry. The forester deals with forests, the highest development of vegetation, in a natural or nearly natural condition, and it is therefore greatly to his advantage to know the laws governing the life of a forest, such as the amount of new wood being produced annually on different soils, the probable effect of cutting out some of the trees or underbrush, the normal frequency of fire, and the influence of insects, grazing animals, and other enemies.

The farmers who cut wild hay from the meadows and marshes of New England and the prairies of the west also have similar problems on a smaller scale, and if they know beforehand just what to expect in the long run from each type of meadow or prairie vegetation so much the better for them.

The art of agriculture has less to do with plant sociology and demography than with ecology. For the growth and yield of cultivated plants depends mainly on the environment and the care given them, but the manner in which they associate is determined artificially and has no particular significance. But weeds come in uninvited, and the effect of their competition is more or less of a sociological problem. And a knowledge of some of the principles of plant sociology is useful to settlers in a new region. The pioneer farmers who clear new land for the plow have long been accustomed to judging its fertility by means of the aspect of the vegetation on it, and if this rather empirical qualitative knowledge could be supplemented by a determination of the annual growth of vegetation much more definite correlations could be made. In a wooded region this would involve some difficulties, but in a prairie region it is as simple as measuring the yield of hay.

Lastly, by a study of the comparatively simple and obvious phe-

nomena of plant sociology one might get some valuable light on the analogous but more recondite problems of human sociology, and a clearer conception of its scope and subdivisions. Plants have the advantage of being fixed in one spot, and they show more delicate responses to environmental conditions and are more easily experimented with than human beings.

Although the opportunities for studying plant sociology are growing less every year with the encroachments of civilization on the forests, marshes and prairies, and some types of vegetation have already disappeared as completely as the Indian tribes of the eastern states, there are still several thousand acres of essentially natural vegetation even within the corporate limits of New York and Chicago, more remote regions are continually being made more accessible by the extension of transportation lines, and some areas of special interest are being set aside as national and state parks or forests, so that the new science is likely to have a healthy growth for some time to come.